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A bibliographic study of civil construction's planning advantages

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Abstract - *Planning is one of the most important tools for successful enterprises of various organizations. When is well executed, enables positive gains in relation of productivity, timeliness and reduced costs. Currently, it is noted there is a growing demand for the implementation and improvement of this process in the Brazilian construction companies. Large construction companies achieved a significant advance in this process which, although still present flaws, is well ahead of what is being done by builders small. On these, the practice of planning is still applied misguided or even nonexistent. This paper proposes to make a literature review about this theme, describing the importance of planning, their types, their steps and tools inherent to the civil construction sector.*

Key Words: planning, construction management, civil construction, planning tools, construction sites.

1.INTRODUCTION

Due to the changes in various global scenarios over time, such as increased competitiveness, globalization of markets, growing demand for modernization, the emergence of new technologies, and increasing consumer demand and the scarcity of financial resources, Civil Construction was obliged to make some modifications [2].

With the advent of globalization in the economy, on a global scale, new methods of business administration were developed, making it possible to increase productivity and process quality in the Civil Construction industry, especially in the building production sector [2].

For the construction companies, it became essential to invest in management and control of processes, which allowed a guarantee of the indicators of term, cost, return of invested capital and cash flow [11].

In this context, many researches have focused their research on the focus of so many failures and, consequently, on the difficulties encountered in dealing quickly and effectively with the obstacles characteristic of the process execution phase. Most pointed to the absence or inadequate introduction of what we now call Project Management in the enterprises of the time, thus awakening the attention of companies to the importance of good planning followed by an adequate control of the activities proposed for each sector [11].

2. PLANNING

Planning is a process that takes into account the experiences previously experienced by an organization, in order to establish a more efficient execution plan for a current goal. This plan should focus the best efforts and resources available on the organization during the implementation period [16].

According to Chiavenato (2004), planning can be understood as the first of the management functions, since it is the one that enables the determination of the organizational objectives, as well as the identification of the resources available to reach them in the best possible way [6].

Also, planning can be considered as a tool that can serve, in a way, as a guarantee of the perpetuity of a company by the ability of managers to respond quickly and accurately by monitoring the evolution of the enterprise and eventual strategic redirection [15].

2.1 Types of planning

The literature presents several criteria to differentiate the types of planning relating them to the areas in which they will act. The criteria chosen to guide the present paper are those that fit the logic of Project Management: planning in terms of their dimensions and time.

According to LAUFER and TUCKER (1987), the representation of the production planning and control process can be done through two basic dimensions: horizontal and vertical. The horizontal dimension refers to the steps necessary for the planning and control process to be carried out. The vertical dimension indicates how such steps must be associated between the different hierarchical levels of an organization [13].

Another definition says that planning refers to a management process capable of establishing the best direction to be followed by an organization, in order to optimize the degree of interaction between internal and external agents, acting in an innovative and differentiated way. It is a tool that allows, counterbalance the uncertainties; focus on goals; facilitate control, evaluation and improvement of results; identify opportunities and consolidate the competitive advantage of a particular company [15]. In this context, strategic planning is included, which is broader because it covers all the resources and areas of activity of an

institution, aiming to achieve its objectives at an organizational level. In addition, it is a tool designed for the long term, where its effects can be perceived over several years. Its definition is agreed by the top of the organization, configuring itself in the main plane, to which all the others must be subordinated [7].

The methodology of Long Term Planning was developed in the United States during the 1950s, due to the great influence of countries that already incorporated in their economic models an economy system planned for the long term. Over time, due to the needs and the sectorial organization of the companies, the Medium and Short Term plans were incorporated [2].

Planning established at the macro level of the organization, where the main characteristics of each stage are defined. Its elaboration is carried out by the board and then its content is transmitted to the lower segments [22].

Medium-term planning is designed so that the person responsible for each specific department can define, from the long-term plan, what will be the sequence of activities to be carried out in their sector [2]. Complementing the previous description, referring to the medium-term planning as one that is established for the production of each sector separately according to the resources that each one of them has [19]. As regards their duration, medium-term plans have a duration of one to two years within the company [5].

Regarding short-term planning, a state that the latter's main function is to transfer the "service packages" so that those responsible for each work team can verify the execution aspects. Thus, those responsible for each team define the tasks to be performed, the best executive sequence and the deadlines for the finalization of each "service package" [2].

3.PLANNING OF WORKS IN CIVIL CONSTRUCTION

Civil Construction can be classified as a set of activities related to the field of engineering, whose purpose is to meet human needs through modifications and adaptations in natural scenarios, through the most varied forms of construction works construction [17]. Most of these activities are characterized by a high degree of complexity, as well as a great variety of professionals and suppliers of materials, tools and techniques willing to show their competitive advantages for this market. Thus, it is common for the construction companies to run into problems generated by lack of appropriate technology, labor with a low level of qualification, lack of concern with sustainable aspects, timelines in total mismatch, unexpected costs, among others [13].

Every productive process contemplates the transformation of raw materials into some product, but not all of these processes can effectively achieve what was planned. Thus, there are a number of variables that can intervene in the final result, but with a well-done planning, one can predict the existence of these factors and thus minimize them [9].

In the construction industry there is the transformation of various inputs (cement, sand, gravel, gypsum, steel, asphalt, etc.) and labor in products such as houses, apartments, roads, bridges and others [15]. As mentioned above, in a constructive process there are also many factors that need to be managed, through production planning and control methodologies in order for the company to achieve its goals. Failure to use these management methods leads to waste of material and labor, causing costs, deadlines and decreasing the companies' constructive potential [17].

In order to guarantee a good planning of the works, it is necessary that both the planning and the execution are aligned in relation to the procedures and sequences of activities to be adopted. However, one great difficulty has been to reconcile planning and execution information in order to ensure that the work is well controlled and that planning does not become something disposable [15]. According to MARCHESAN (2001), the productive process in the civil construction ends up being driven by informal plans, elaborated by the executors of the work that, often, are different from the formal plans [14].

When the work is not carried out as planned, the builder is exposed to the risk of not meeting construction deadlines and costs. When defining such parameters, it is based on an initial macro planning that must be followed. Therefore, the non-planning and control of production impacts directly on the production of the work, which will also affect the costs and possibly the competitiveness of the product [14].

In this context, planning favors the competitiveness of the company, guaranteeing the managers of the enterprise to make fast and efficient decisions by monitoring the progress of the enterprise.

Planning is currently one of the main factors for the success of any enterprise [10]. Thus, according to CARDOSO; ERDMANN, (2001) planning is the definition of the moment at which each activity must be completed and the development of a production plan that shows the deliveries of the activities according to necessity and order of execution. In addition, it is responsible for demonstrating the type of activity to be performed, when to run, the building systems and resources used [3].

Planning has several functions, such as support for material procurement, contract closure and technical guidance on material applications or service execution [9]. According to GUTSCHOW (1999), the execution of the works according to the plan allows to have stabilized processes in the execution of the construction works and of any other enterprise [11].

The act of planning requires time and specific knowledge. The professional in charge of planning, in turn, must have experience mainly in the construction site, because the fundamentals that are in bibliographical references of consumption of material, productivity and as to the constructive techniques are only a parameter, thus, to be executed planning in the most appropriate way, experience at the construction site is of the utmost importance [11].

The planning and control of a construction site are closely linked to other important sectors of the company and have a direct relationship with the entire type of enterprise. Figure 1 shows how the planning of the work is part of a process that has interfaces with other internal processes and systems of the company [9].

Fig -1: Structure of a planning sector [9]

3.1 Stages of Construction Site Planning

Planning is of fundamental importance for the success of any enterprise, and in construction it is no different. A well-designed planning facilitates the work of the manager, guiding him in relation to the deadlines, costs and results expected at each stage [8].

In order to have an efficient planning of the work, it is necessary that the following steps are followed in order to ensure that the necessary information is collected, are they [12, 14]:

- Physical schedule

In order to create a physical bar schedule, the first step is to define the internal variables, such as labor unproductivity at certain times of the year and at the beginning of activities, and external variables such as holidays and rainy periods [5].

The next step is to list all activities, their durations, predecessors, and the project start date. The physical schedule is generated from these data. Among the different planning techniques, the one that best fits the civil construction is the Precedence Networks (PERT / CPM) [15].

- Definition of durations

According to MATTOS (2010), every schedule activity must have a duration associated with it. This duration depends on the amount of service, productivity and the amount of resources allocated. These three quantities are mathematically related to each other. It is up to the planner to define the most suitable term / team relationship and adopt it in the time frame.

In practice, the duration of each activity is variable due to internal constraints, such as absenteeism, productivity, financial problems, etc. And external, such as heavy rains and delayed delivery of materials by suppliers. These variables should be predicted in the planning and duration should be adopted as a variable [4, 21].

- Precedence definition

The definition of precedence consists in the definition of the sequence of activities. It is the dependence between tasks based on the constructive methodology of the work. At this stage it is important to have defined the constructive logic, the construction plan, the relationship between the activities and the sequence of services as coherent as possible [15, 20].

It is also necessary to define the precedence type between activities, for example, one task can start only when another completes (end-start) or starts when the other starts (start-start) [15, 20].

- Mounting the network diagram

After the definition of durations and predecessors, the next step is the graphical representation of activities and their logical dependencies through a network diagram. The two methods most used for the construction of this diagram are the arrow method and the block method [15].

- Schedule creation and clearances calculation

According to MATTOS (2010), the end product of the planning is the creation of the schedule, represented in the form of Gantt Chart. It represents the position of each activity more clearly over time. To CARDOSO, R. S. (2014), for some activities, the initial time should not necessarily be equal to the final time of the activity that precedes it, that is, it may have a gap to start. These gaps should be identified and analysed.

- Critical Path Identification

The sequence of activities that has the longest term is what we call the critical path. The delay in a critical activity affects the duration of the project, so it is imperative that more attention be given to them so that they do not delay or reduce the execution time, which allows the delivery of the work in a shorter period or to save time in other activities. [15, 21].

- Financial physical schedule

The financial schedule is created by allocating resources to each activity. It is estimated the amount that will be spent per time period. This schedule organizes expenses according to the period of execution of each service, allowing better control and forecasting of expenses, assisting in the organization of cash and obtaining bank financing, as it is part of the documentation required by banks for this purpose [4, 15].

- Purchase schedule

In order to make it possible to meet the deadlines stipulated in the planning, it is necessary that the materials used for each activity be delivered to the work before the scheduled start date. For this reason, it is important to create a purchase schedule defining the date of delivery of the

material and the date on which the material is to be purchased, respecting the beginning of the activities, space available for storage and delivery time informed by the supplier [4, 15]

3.1 Advantages of Planning

RAD (1983) concluded that there is rarely a definite method for planning the site, observing in surveys with construction managers that the plans were elaborated based on experience, common sense, and adaptation of past projects to situations current [19].

Thus, the non-observance of the planning activity of an enterprise causes many companies to fail to guarantee the various advantages that this activity brings with it. Planning assures the company of advantages over the term, cost and quality of the enterprise [19, 21].

The prediction of unfavorable situations and indications of nonconformity are benefits of planning and, from these identifications, it is possible to take measures in time, to adopt preventive and corrective measures, and to try to minimize the impacts on the cost and the term [8, 20].

In addition to the aforementioned benefits, planning has a number of other advantages. As pointed out by CIMINO, JR in his publication "Planning and execution of work" (1987) and by GOLDMAN, P. in the publication "Introduction to planning and cost control in Brazilian civil construction" (2004), we can still list the following advantages of planning:

- Demonstrate through reports and graphs, physical advancement, to give decision-making subsidies to contract management;
- It establishes a clear vision of how planning can be hierarchized between different levels of management;
- Defines the role of each involved in the process;
- Carry out the critical analysis of the physical progress of the work and results that interfere in the conclusion of the same, through weekly reports;
- Evaluation of the availability of resources to meet the deadlines and allows the analysis of weekly schedules;
- Approval of payment events, integrated change control, out of scope services, creation and updating of the WBS, analysis of value added to the project;
- Registration and monitoring of project risks;
- It reduces the probability of errors in the execution of the project due to the improvement of the layout and design of the physical flows, as well as facilitates the establishment of standards for the control of the work.
- It increases the degree of participation of all the members of the administration in setting goals;
- Facilitates delegation of powers;
- It tends to improve the use of resources, as well as to adjust them to priority activities;
- It ensures greater security and reliability in the physical and financial schedules and greater progress in productivity rates, leading to reduction of losses and improving actual costs.

As can be seen, planning is fundamental for reducing costs and fulfilling deadlines by companies.

3.2 Critical failure factors

In a study made by Iyer and Jha (2004) was verified there are seven critical failure factors [12].

The first one is conflict among project participants. The attributes under this factor mainly explain either the difference of opinion or lack of coherence in some way barring one or two attributes. The top management must devise suitable means to avoid conflict among participants [12].

The second factor analysed by Iyer and Jha (2004) was ignorance and lack of knowledge of project manager. While a competent project manager becomes responsible for success of the project, ignorance and lack of knowledge of project manager can cause failure as seen from this factor. Contracting organisations are well advised not to compromise on the competence of project manager. The top management can devise means to supplement the knowledge needs of project participants by providing training at regular intervals [12].

Another factor presented by the authors is the presence of poor project specific attributes and nonexistence of cooperation. Inadequate project formulation in the beginning; uniqueness of the project activities requiring high technical know-how; holding key decisions in abeyance and the other category has attributes related to nonexistence of cooperation among project participants in the form of conflicts and passing blame [12].

The fourth factor is hostile socio economic and climatic condition. It affects the cost performance adversely in the form of frequent stoppage of work, labour unrest, and reduced productivity [12].

Besides these factors there is also reluctance in timely decision. Additionally, aggressive competition at tender stage is another factor that contributes to failure. . Since most of the times such projects land up in disputes arising out of petty things and claims/counterclaims extend the duration of the project resulting into large cost overrun [12].

The last factor is related to short bid preparation time. The project duration generally includes the time from conception/approval stage till execution and handing over. In order to gain time for execution or unforeseen events, owners or their representatives tend to squeeze the bid preparation time itself. The short bid preparation time leads to a number of errors/omissions on contractor's part which they try to settle later through claims. This raises disputes and finally the project lands up with schedule and cost overruns [12].

3. CONCLUSIONS

In view of the planning study, it was possible to understand and identify how this practice is important and necessary for the achievement of efficiency in the processes of building production, especially in terms of term, cost and quality of construction.

In civil construction, planning proves to be one of the differentials for the success of any enterprise. It allows the channeling and guidance of information and knowledge from various sectors of the company in order to allow established goals to be achieved in the best way and efficiency.

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